California High-Speed Rail Authority

RFP No.: HSR 14-32

Request for Proposals for Design-Build Services for Construction Package 4

Book IV, Part E.1
Verification Validation and Self-Certification Procedures

Table of Contents

Figures

Table

NO TABLE OF FIGURES ENTRIES FOUND.

1 Introduction

This Construction Package is a civil/structural package, but part of the California High-Speed Rail System (CHSRS), which incorporates trackwork, stations, storage and maintenance facilities, train sets and railroad systems. The Verification and Validation (V&V) process is a critical aspect of this design workflow to provide for a completely integrated system in the future. The contractor shall provide time and resources necessary to conduct a thorough Verification and Validation, in accordance with the process specified in this procedure.

This section includes:

1. Requirements for Contractor Self-Certification (SC) to certify that the Technical Contract Submittals[1] conform to Technical Contract Requirements as detailed in the Contract and as reasonably inferred therefrom. The Self-Certification Process is embedded in the CHSTS V&V process.
2. Verification and Validation requirements for Contractor supporting the Self-Certification by provision of documented objective evidence to demonstrate compliance with the Technical Contract Requirements set forth in this Contract.

The Contract differentiates between Technical and Non-Technical Contract Requirements and Technical and Non-Technical Contract Submittals.

Technical Contract Requirements (TCR) are defined as Contract Requirements specifying the characteristics of the final infrastructure deliverable including related final design[2], construction, inspection, testing, and acceptance requirements. Technical Contract Submittals (TCS) are defined as the Contract submittals that address the Technical Contract Requirements, including, but not limited to:

- Final design drawings, specifications and reports
- Ready for construction (RFC) drawings and specifications
- Inspection plans, procedures, and reports
- Test and acceptance plans, procedures, and reports
- As-built drawings and specifications

[1] Refer to the Scope of Work for the Technical Contract Submittal List.

[2] Final design shall be defined as per 23 CFR 636.103 and means any design activities following preliminary engineering and expressly includes the preparation of final construction plans and detailed specifications for the performance of construction work. Any design submittal shall be considered a final design submittal, including 60%, 90%, and RFC designs.

Non-Technical Contract Requirements (NTCR) are the remainder of the Contract Requirements such as Project Management, Commercial, Legal or other Contract Requirements. Non-Technical Contract Submittals (NTCS) are defined as Contract submittals that address Non-Technical Contract Requirements, including Project Management Plans, Schedules, Invoices, etc.

Objective evidence is defined as Technical Contract Submittals provided by the Contractor that, when independently reviewed, clearly demonstrate that the TCRs have been met.

If the Contractor includes Technical Contract Requirements in Non-Technical Contract Submittals, the submittal shall be treated as a Technical Contract Submittal.

This section does not include:

- Submittal and review requirements for non-technical submittals, including management related and administrative submittals. Refer to the General Provisions for NTCS requirements.
- List of individually required Contract Submittals
- Quality control/assurance requirements
- Specific inspection and testing requirements

Refer to the applicable Contract provisions for the requirements not included in this section. Unless otherwise noted, all requirements in this document shall be performed by the Contractor.

In the event that a requirement of this section conflicts with another Contract requirement, the most stringent requirement or interpretation shall apply.

1.1 Reference Standards

- International Electrotechnical Commission (IEC)
  - IEC 10007 – Quality management system – Guidelines for configuration management (latest version)
- International Council on Systems Engineering (INCOSE)
  - INCOSE Systems Engineering Handbook

1.2 Terms and Acronyms

Term	Definition
Authority	California High-Speed Rail Authority
Authority's Representative	PCM, RDP or Authority
CCP	Certificate of Conformance Package
CI	Critical Item
CIL	Certifiable Items List, List of Critical Items
Contract Requirement	Any part of the Contract that requires an action or deliverable to be performed by the Contractor.
Contract Submittals	Submittals other than V&V submittals as required in this Contract
CVVP	Contractor Verification and Validation Management Plan
DBR	Design Baseline Report
DCAR	Design and Code Analysis Report
Fitness for Purpose	A product is suitable for the intended purpose
HSR	High Speed Rail
HST	High Speed Train
ICD	Interface Control Document
IM	Interface Management
NTCR	Non-Technical Contract Requirement
NTCS	Non-Technical Contract Submittal
NTP	Notice to Proceed
PCM	Project and Construction Management
QA/QC	Quality Assurance / Quality Control
PHA	Preliminary Hazard Analysis
RDP	Rail Delivery Partner
RDW	Roadway
RFC	Ready for Construction
RM	Requirements Management
RVTM	Requirements Verification Traceability Matrix
ROD	Record of Decision
SC	Self-Certification
SONO	Statement of No Objection
SUB	Submittal
Subject to SONO	Submittal subject to a review by the Authority's Representative
Technical Contract Requirement	Contract Requirements specifying the characteristics of the final infrastructure deliverable including related final design, construction, inspection, testing, and acceptance requirements.
Technical Contract Submittal	Contract submittals that address the Technical Contract Requirements
TCR	Technical Contract Requirement
TCS	Technical Contract Submittal
TCSL	Technical Contract Submittal List
TSR	Type Selection Report
TVA	Threat and Vulnerability Assessment
V&V	Verification and Validation
Validation	Confirmation by examination and provision of objective evidence that the particular requirements for a specific intended use have been fulfilled
Verification	Confirmation by examination and provision of objective evidence that the specified requirements have been fulfilled

2 Products

2.1 Contractor Verification and Validation Management Plan

Verification & Validation Management in the California High-Speed Train Project is defined as a systematic engineering process based on generally accepted project management and systems engineering practices (INCOSE Systems Engineering Handbook, 4th Edition (2015)).

Develop and implement a Contractor Verification and Validation Management Plan (CVVP) for the project that addresses the following processes:

- Verification and Validation Management process (Section 2.1.1)
- Requirements Management process (Section 2.1.2)
- Design Management process (Section 2.1.3)
- Interface Management process (Section 2.1.4)
- Inspection and Testing Program Management process (Section 2.1.5)
- Quality Program and Quality Management System (Section 2.1.6)
- Change Control and Configuration Management process (Section 2.1.7)

The Contractor may choose to submit the CVVP as individual management plans describing each process separately or as a consolidated management plan. Schedule a CVVP kick-off meeting with the Authority's Representative and agree on the approach before preparing and submitting the CVVP.

The CVVP shall address for each process:

- Contract life cycle stages (final design, construction, and testing/acceptance)
- Decision gates (reviews, milestones) for each life-cycle stage including decision gate (acceptance) criteria to move forward
- Inputs used for each stage
- Outputs (deliverables) for each stage
- Associated activities and processes for each deliverable
- Responsibility assignment matrix for deliverables and activities
- Tools and methods used
- Stakeholder coordination
- Performance metrics and reports used to measure and report progress
- Sample Submittal Specific RVTM form

- Sample Submittal Specific CIL form
- Annotated outlines of Certificate of Conformance Packages (CCP)
- Schedule including all V&V life-cycle stages, decision gates, deliverables and associated activities

Decision gates shall include: notice to proceed (NTP), design code analysis report (DCAR) review, design baseline report (DBR) review, type selection report (TSR) review, 60% design review, 90% design review, ready for construction (RFC) review, inspection and test plan (ITP) review, inspection and test procedure review, inspection and test results review, certification and final acceptance).

Activities for each life-cycle stage shall be described as individual processes including inputs, steps performed, outputs, applicable roles and responsibilities as well as supporting tools and methods as depicted in Figure 1.

Submit the CVVP as specified in Section 3.4.

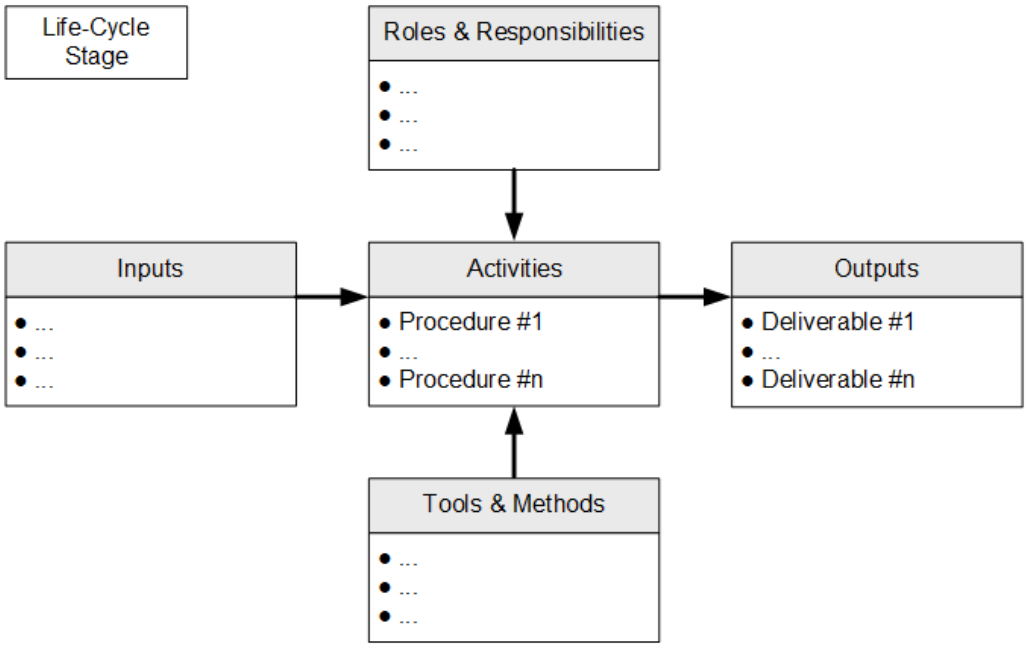

Figure 1: Contractor Verification and Validation Plan by Life-Cycle Stage

2.1.1 Verification and Validation (V&V) Process

The V&V process is the core process depending on the other processes described above, e.g. Verification and Validation can only be successfully performed against Technical Contract Requirements. The TCRs will be addressed by Technical Contract Submittals, while changes to TCRs have to be managed.

The Contractor shall develop and implement a comprehensive V&V process to demonstrate how each Technical Contract Requirement is met during final design, construction, inspection, testing, and certification.

The V&V process shall be fully and seamlessly integrated with the Plans, Specifications and Cost Estimates (PS&E) approach of an infrastructure project, and shall include:

- Planning:
  - Plan and implement Verification and Validation process, including the preparation and use of RVTMs (Section 2.3.1) CILs (2.3.2), and CCPs (Section 2.3.3) during final design, construction, inspection, testing, and certification
  - Plan and implement Requirements Management Process (Section 2.1.2), and set up the Requirements Management Tool (Section 2.2)
  - Plan and implement Design Management process (Section 2.1.3)
  - Plan and implement Interface Management process (Section 2.1.4)
  - Plan and implement Inspection and Testing Program Management process (Section 2.1.5)
  - Quality Assurance and Quality Control process (Section 2.1.6)
  - Plan and implement Change Control and Configuration Management process (Section 2.1.7)
- Execution:
  - Perform Requirements Management activities
  - Perform Design Management activities
  - Perform Interface Management activities
  - Perform Inspection and Testing Program Management activities
  - Perform Quality Assurance activities
  - Perform Change Control and Configuration Management activities
- Monitoring and Control:
  - Perform Verification & Validation activities
  - Perform Quality Control activities
  - Perform Certification activities
  - Perform Change Control and Configuration Management activities

The Verification and Validation process shall be submitted as part of the CVVP.

Execution of the V&V Work shall not start before the Planning of the V&V Work has been completed.

Coordinate the V&V process with the Quality Assurance / Quality Control (QA/QC) process (Section 2.1.6).

The V&V lead person shall meet the requirements for Contractor Key Personnel as specified in Section 3.2.1.

2.1.2 Requirements Management Process

Develop and implement a comprehensive requirements management (RM) process, defining how the Technical Contract Requirements are captured, traced, managed, verified, and validated.

Requirements management planning shall include:

- Development of Requirements Management Plan
- Setup of Requirements Management Tool (Section 2.2.1)
- Capturing the Technical Contract Requirements (Section 2.2.2)

Requirements management execution shall include:

- Tracing the Technical Contract Requirements (Section 2.2.3)
- Managing the Technical Contract Requirements (Section 2.2.4)

Requirements management monitoring and control shall include:

- Verifying the Technical Contract Requirements (Section 2.2.5)
- Validating the Technical Contract Requirements (Section 2.2.6)
- Reporting on the Requirements Management Progress (Section 2.2.7)

Submit the Requirements Management Plan as part of the CVVP or individually, as defined in Section 2.1.

Manage Technical Contract Requirements in the RM tool as specified in Section 2.2.

Demonstrate compliance to Technical Contract Requirements using the RVTM as specified in Section 2.3.1.

Demonstrate compliance to Critical Items using the CIL as specified in Section 2.3.2.

Certify compliance to Critical Items using the Certificate of Conformance Package as specified in Section 2.3.3.

The RM lead person shall meet the requirements for Contractor Key Personnel as specified in Section 3.2.1.

2.1.3 Design Management Process

Develop and implement a comprehensive design management (DM) process, defining how the Technical Contract Requirements are advanced into the final design.

Design management planning shall include:

- Development of Design Management Plan
- Definition of Design Submittal Types, including:
  - Design and Code Analysis Report (DCAR)
  - Design Baseline Report (DBR)
  - Type Selection Report (TSR)
  - HST At-Grade (Guideway)
  - HST Aerial Structure and/or Bridge
  - HST Trench
  - HST Tunnel
  - Roadway (RDW) Overpass
  - Roadway (RDW) Underpass
  - Reports (broken out as necessary, e.g. Geotechnical, Utility Reports, etc.)
  - Calculations
  - Other as defined in the Design Management Plan
- Definition of Design Submittal Completeness by Design Submittal Type for each decision gate: It shall be unambiguously clear which Technical Contract Requirements (TCR) and Critical Items (CI) are addressed at which stage of the design using which submittal type (e.g. fall prevention barriers will be shown at the 60% stage on RDW Overpass submittals).

Design management execution shall include:

- Preparation of design submittals
- Performing of Quality Assurance activities

Design management monitoring and control shall include:

- Verifying the design submittals against the applicable TCRs (Section 2.2.5)
- Validating the design submittals against the applicable TCRs (Section 2.2.6)
- Performing of Quality Control activities

Submit the Design Management Plan as part of the CVVP or individually, as defined in Section 2.1.

Demonstrate compliance to Technical Contract Requirements using the RVTM as specified in Section 2.3.1.

Demonstrate compliance to Critical Items using the CIL as specified in Section 2.3.2.

Certify compliance to Critical Items using the Certificate of Conformance Package as specified in Section 2.3.3.

The design management lead person shall meet the requirements for Contractor Key Personnel as specified in Section 3.2.1.

2.1.4 Interface Management Process

This contract is part of the overall California High-Speed Train Project (the Project). Many external interfaces and dependencies exist between this contract and other Project contracts and stakeholders.

Develop and implement a comprehensive interface management (IM) process, defining how interfaces are identified, captured, specified, managed, verified, validated, and certified.

Interface management planning shall include:

- Development of Interface Management Plan. Refer to the General Provisions for more details on interface management requirements
- Forming an Interface Coordination Team
- Identification and capturing of interfaces in the interface register
- Planning Interface Coordination Workshops

Interface management execution shall include:

- Performing mandatory Interface Coordination Workshops
- Preparation of an Interface Control Document (ICD) for each interface including interface requirements and preliminary interface designs
- Reviewing interface requirements and preliminary design for each identified interface
- Advancing the interfaces requirements to the level required for final design
- Developing final interface designs
- Managing the changes to the interface requirements and design including agreements reached during the Interface Coordination Workshops
- Tracing from the interface register to the interface requirements, interface design and interface inspection, test and acceptance documents
- Updating the ICDs to include for each interface the corresponding interface requirements, interface design, and interface inspection, test and acceptance documents

Interface management monitoring and control shall include:

- Verifying the ICDs and applicable design submittals
- Validating the ICDs and applicable design submittals
- Certifying interfaces using ICDs (Section 2.3.3.2)

The Interface Management Plan shall include a list of all planned interface coordination workshops, identifying which interfaces identified in the Interface Register are addressed in which coordination workshop. Submit the Interface Management Plan as part of the CVVP or individually, as defined in Section 2.1.

The Contractor will be provided with an Interface Register readily importable into the RM tool (e.g. as a .dpa file) within twenty (20) working days after acceptance of the Interface Management Plan. The list of interfaces is provided in Appendix B as a reference. Import the provided Interface Register and manage the interfaces in the RM tool.

Interface coordination workshops shall be planned and performed in a structured manner and discuss interfaces as identified in the interface register. Interface coordination workshops shall be held as often as necessary to resolve interface conflicts prior to the 60% design submittals.

Create an Interface Control Document for each interface. ICDs shall be the only means of managing and documenting interface requirements and designs. Each ICD shall contain:

- Interface requirements from Contract
- Preliminary interface design from Contract
- Final interface design
- Approved clarifications and changes
- Interface as constructed (as-built drawings)
- Interface certification

ICDs shall be kept current and updated prior to the next interface coordination workshop.

Demonstrate compliance to interfaces using the CIL as specified in Section 2.3.2.

Certify compliance to interfaces using the Certificate of Conformance Package as specified in Section 2.3.3.

The IM lead person shall meet the requirements for Contractor Key Personnel as specified in Section 3.2.1.

2.1.5 Inspection and Testing Program Management Process

Develop and implement a comprehensive inspection and testing program, defining how the Technical Contract Requirements are validated.

Inspection and test management planning shall include:

- Development of a project inspection and test management plan, defining how TCRs are inspected, demonstrated, analyzed, and tested
- Development of individual inspection and test management plans

Inspection and test management execution shall include:

- Preparation of individual inspections and tests
- Development of inspection and tests procedures
- Execution of inspections and tests plans and procedures
- Preparation of inspection and test reports

Inspection and test management monitoring and control shall include:

- Validating the inspection and test submittals
- Certifying the inspection and test submittals

Develop individual inspection and test management plans, including the following:

- Prototype Testing
  - Use only products that have been proven in comparable high-speed-rail projects.
  - If products not used on comparable high-speed rail projects are proposed, prototypes of or incorporating those products shall be built and type-tested prior to First Article Production.
  - Retain the services of an independent test lab to demonstrate and certify product compliance to the Technical System Requirements and Final Design.
- First Article Compliance Inspection
- Production Run Testing (i.e., at supplier facility during manufacturing)
- Factory Acceptance
- Inspections
- Site Installation
- Site Acceptance
- Integration Testing[3]
- Reliability, Availability, Maintainability Testing

[3] As applicable to this Contract.

For each inspection and test, address the following:

- Inspection and test preparation
- Inspection and test coverage
- Inspection and test execution
- Inspection and test reports
- Inspection and test failure reporting, analysis and corrective action system
- Regression inspection and testing

Submit the Inspection and Test Management Plan as part of the CVVP or individually, as defined in Section 2.1.

Manage the inspections, testing, and acceptance in the RM tool.

Demonstrate compliance to Technical Contract Requirements and final design using the RVTM as specified in Section 2.3.1.

Demonstrate compliance to Critical Items and interfaces using the CIL as specified in Section 2.3.2.

Certify compliance to Critical Items using the Certificate of Conformance Package as specified in Section 2.3.3.

The lead person for the inspection and test program management shall meet the requirements for Contractor Key Personnel as specified in Section 3.2.1.

2.1.6 Quality Assurance (QA) and Quality Control (QC) Process

Develop and implement a comprehensive Quality Program and Quality Management System including QA/QC processes as described in the General Provisions.

The quality management plan shall include quality procedures that fully and seamlessly integrate with the V&V process.

Quality Planning: Any design, material, inspection, testing or other checklists used shall include appropriate section references to the Contract as required for RVTMs (Section 2.3.1). Provide sample forms in the Contractor Quality Management Plan for use in implementing this V&V process.

Quality checklists shall be a subset of and be based upon the apportioned and derived Technical Contract Requirements, refer to Section 2.2 for details. Do not develop inconsistent quality checklists that are not based on Technical Contract Requirements.

Manage QA/QC checklists in the Requirements Management tool (Section 2.3.1). Allow the QA/QC checklists to be filtered and exported in Microsoft Word, Excel and Adobe PDF formats.

Quality Assurance: Develop detailed and auditable QA processes that serve to measure the effectiveness of the V&V process and include them in the Contractor's Quality Management Plan.

Quality Control: Coordinate the QA/QC checklists with RVTMs as figuratively depicted in below:

Contract		QC Check	V&V References
Contract Reference #1	Technical Contract Requirement #1	√	… …
…	…	…	…
Contract Reference #n	Technical Contract Requirement #n	√	… …

Figure 2: Coordination of QA/QC Checklists with RVTMs

2.1.7 Change Control and Configuration Management Process

Refer to the General Provisions and Design Variance Request Procedure of the Contract for overall Change Control and Configuration Management requirements.

Develop and implement a comprehensive change control and configuration management process, defining how changes to baselines are managed. The process shall also address how new or changed information from supporting documents (Section 2.2.4) is incorporated into the requirements, design and construction baselines.

Follow the general provisions of the latest version ISO/IEC 10007 "Quality management systems–Guidelines for configuration management" and as stipulated by the standards listed in this section.

Change control and configuration management planning shall include:

- Development of a change control and configuration management plan
- Identification of Configuration Items and Configuration Baselines, including TCRs and final design baselines (such as the Design Baseline Report)

Change control and configuration management execution shall include:

- Configuration control, including impact analysis and approval procedures including Configuration Control Boards
- Configuration audits

Change control and configuration management and control shall include:

- Configuration status accounting

Apply the change control and configuration management process to ensure integrity between the Work of this Contract and conformance with the HSR program.

Submit the Change Control and Configuration Management Plan as part of the CVVP or individually, as defined in Section 2.1.

Manage the changes in the RM tool using the supporting documents as defined in Section 2.2.4.

The change management lead person shall meet the requirements for Contractor Key Personnel as specified in Section 3.2.1.

2.2 Requirements Management (RM) Tool

Capture, trace, manage, verify, and validate Technical Contract Requirements using an RM tool. The RM tool is foundational to maintaining programmatic visibility over implementation of project (this Contract) specific TCRs. It is critical that the information contained within the RM tool is complete, correct and consistent since it provides evidence of programmatic compliance.

Follow the RM tool implementation concept as pictured in Figure 3.

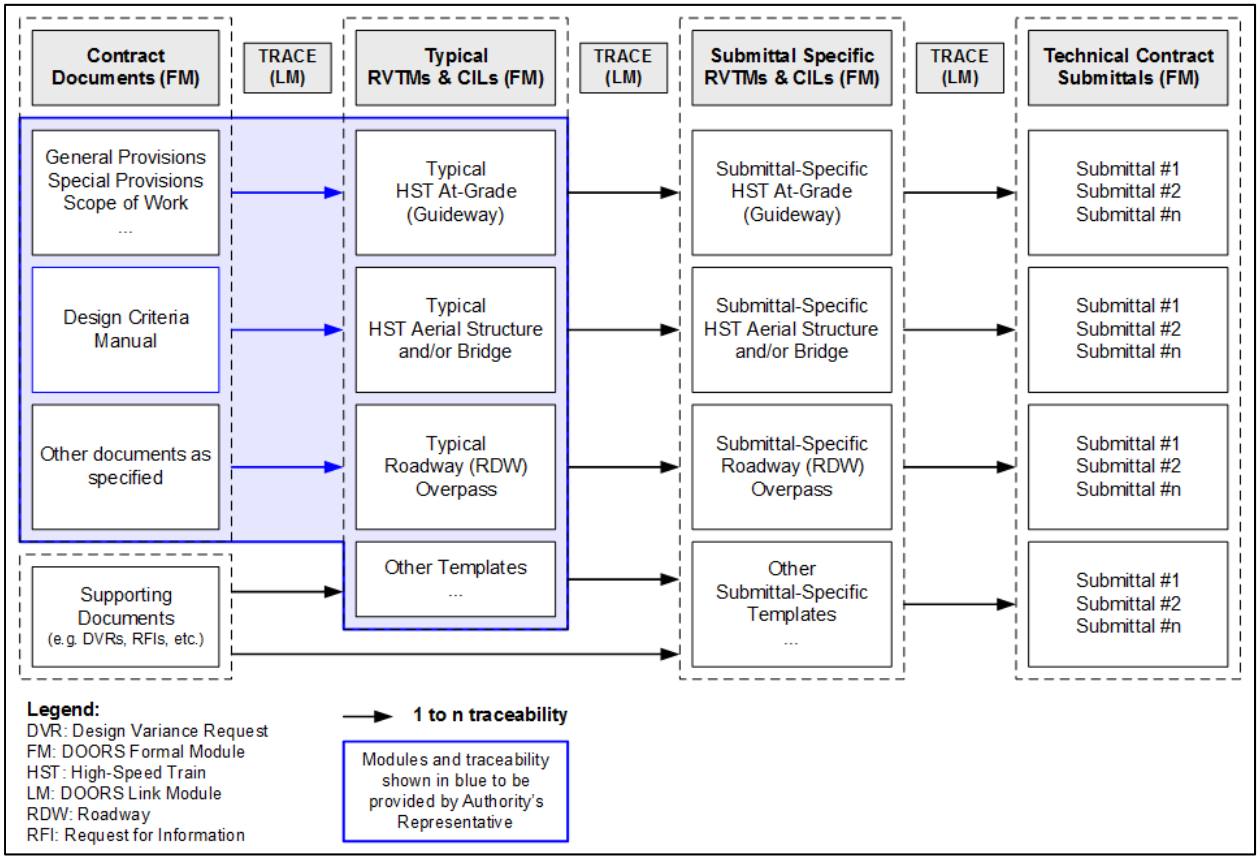

Figure 3: RM Tool Implementation Concept

2.2.1 RM Tool Requirements

The RM tool shall be the latest IBM Rational DOORS 9.X version. Do not use IBM Rational DOORS Next Generation.

Procure and install three (3) IBM Rational DOORS Floating User Licenses (Part Number D09LELL at time of writing the Contract) along with software subscription and support by IBM for the duration of the contract within the timeframe defined in the Submittals Section 3.4. Other types of licenses such as Authorized User Licenses or Web Access Editor Licenses are not acceptable. This requirement is independent from the web access requirement stated below. The disposition of the licenses will be determined at the end of the Contract.

Additionally, enable web access to the RM tool and provide the Authority's Representative with full real-time readability access to the Contractor's RM tool database. One (1) Authority Representative shall be able to access the RM tool at any given time using web access.

Train Authority, PCM and Contractor RM tool users in the operation and configuration of the features of the RM tool requirements, enabling them to perform the requirements of this section.

Manage the final design, construction, inspection, testing, and certification documents as RM tool modules to enable tracing from the TCRs. Allow the automatic export of:

- Requirements Verification Traceability Matrices as specified in Section 2.3.1.
- Certifiable Items Lists as specified in Section 2.3.2.

Do not store any unnecessary, redundant or inconsistent modules. Purge deleted files.

Create Requirements Verification Traceability Matrices (RVTM) and Certifiable Items Lists (CIL) directly from the RM tool.

Submit the RM tool database as defined in Section 3.4. The RM tool database shall be provided as a project archive (.dpa) file.

2.2.2 Capture Technical Contract Requirements

The Contractor will be provided with the Contract documents and typical RVTMs and CILs readily importable into the RM tool (e.g. as a .dpa file) within twenty (20) working days after acceptance of the Contractor Verification and Validation Plan. Import the provided modules and manage the TCRs in the RM tool as described in this document. The folder, files and modules will look similar to the samples shown in Figure 4 and Figure 5.

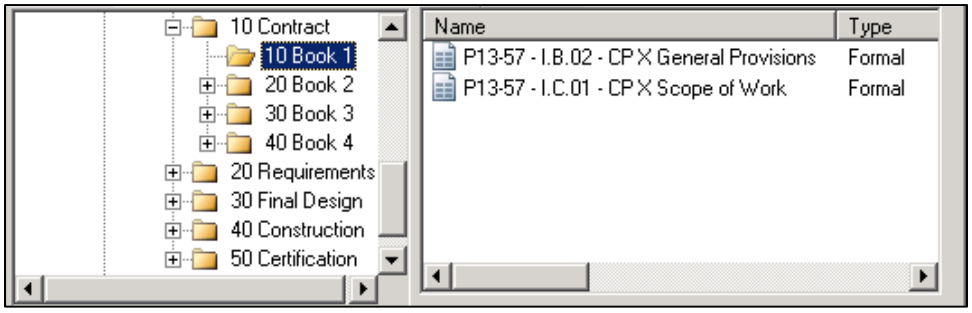

Figure 4: RM Tool – Sample Folder and File Structure

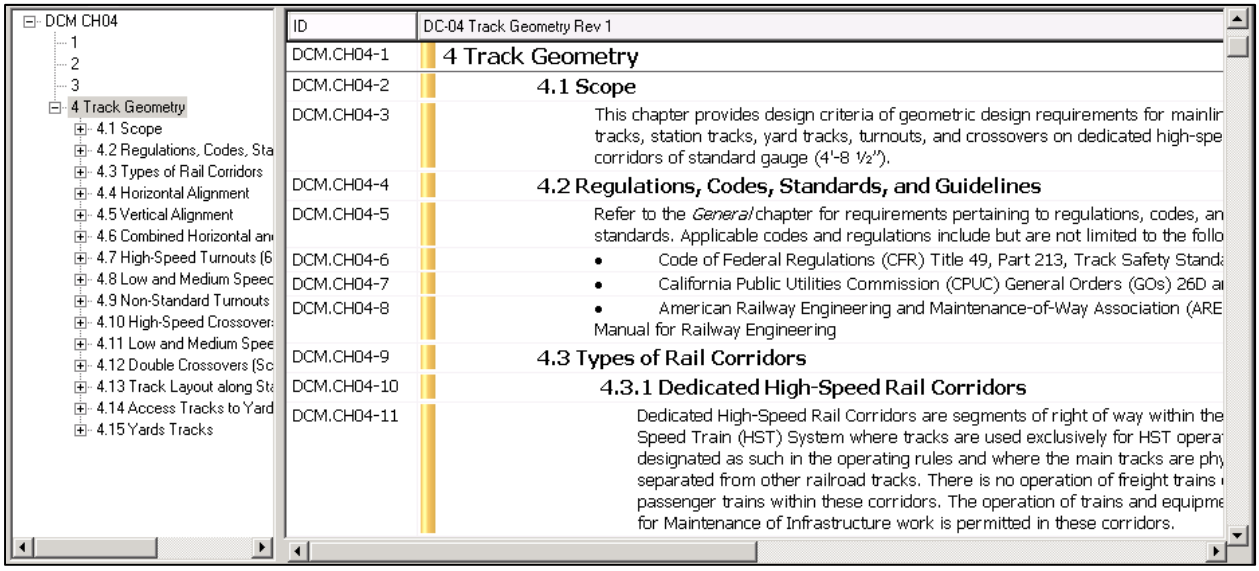

Figure 5: RM Tool – Sample Contract Document

Do not change or edit the original Contract documents.

2.2.3 Trace Technical Contract Requirements

Provide full traceability as depicted in Figure 3 and specified below using the RM tool:

- Supporting Documents (see Section 2.2.4 for definition) to Typical RVTMs and CILs (general clarifications or changes)
- Supporting Documents (see Section 2.2.4 for definition) to Submittal Specific RVTMs and CILs (site specific clarifications or changes)
- Typical RVTMs and CILs to Submittal Specific RVTMs and CILs
- Submittal Specific RVTMs and CILs to Final Design submittals
- Submittal Specific RVTMs and CILs to Construction submittals, including inspection and test submittals
- Submittal Specific RVTMs and CILs to Certification submittals

Tracing shall be accomplished by linking objects between formal modules within the RM tool. Tracing shall be used to create the content of RVTMs and CILs by displaying the linked object attributes. Manually copying text references is not permitted.

Tracing direction shall be top-down, starting with the Technical Contract Requirements. Bottom-up tracing is not permitted.

Tracing shall demonstrate compliance from the TCRs listed in the RVTMs and CILs to the final design, construction, and certification submittals. Use RM tool external traces as required.

Implement a structured approach to storing traces in RM tool link modules. Use the following (link) module naming convention: "LM 'From Module(s)' to 'To Module(s)'", for example: "LM Contract to RVTM". Link modules shall be stored in the RM tool folder from where the traces (links) originate.

2.2.4 Manage Technical Contract Requirements

Technical Contract Requirements shall be kept current upon approved changes or clarifications to the Contract using supporting documents. Supporting documents include, but are not limited to:

- Alternative technical concepts
- Agreements (e.g. third party agreements)
- Directions
- Letters
- Approved change orders and design variances
- Requests for information
- Analyses and assessments, including
  - Design and code analyses
  - Site-specific hazard analyses
  - Site-specific threat and vulnerability assessment
- Studies
- Calculations
- Site inspections
- Reports, including, but not limited to
  - Design baseline reports
  - Aesthetic design and review reports
  - Value engineering reports

  - Hydrology and hydraulics reports
  - Geotechnical and foundation reports
  - Structure reports
  - Seismic design reports
  - Phase II hazardous materials
- Design workshop including Interface Coordination Workshop
- Meetings minutes
- Agreed upon review comments

Capture and trace supporting documents within two (2) weeks of receipt.

The Technical Contract Requirements and associated final design, construction and certification submittals shall be baselined following the Change Control and Configuration Management plan.

2.2.5 Verify Technical Contract Requirements

Demonstrate compliance to the Technical Contract Requirements by provision of objective evidence that:

- Technical Contract Requirements have been kept current upon approved changes or clarifications
- Final design submittals meet the Technical Contract Requirements
- Ready for construction submittals meet the Technical Contract Requirements
- As-built submittals meet the Technical Contract Requirements

Demonstrate compliance to Technical Contract Requirements using the RVTM as specified in Section 2.3.1.

Demonstrate compliance to Critical Items using the CIL as specified in Section 2.3.2.

Certify compliance to Critical Items using the Certificate of Conformance Package as specified in Section 2.3.3.

2.2.6 Validate Technical Contract Requirements

Demonstrate compliance to Technical Contract Requirements by provision of objective evidence that:

- Technical Contract Requirements have been kept current with approved changes or clarifications
- Inspection and test plans and procedures meet the Technical Contract Requirements and the ready for construction design

- Construction items meet the Technical Contract Requirements and the ready for construction design
- Inspection and test reports meet the Technical Contract Requirements and the ready for construction design

Demonstrate compliance to Technical Contract Requirements using the RVTM as specified in Section 2.3.1.

Demonstrate compliance to Critical Items using the CIL as specified in Section 2.3.2.

Certify compliance to Critical Items using the Certificate of Conformance Package as specified in Section 2.3.3.

2.2.7 Performance Metrics and Reporting

The purpose of a performance metrics and reporting shall be to measure the progress against a plan. The Contractor shall create an RM tool module of metrics that measures the following values:

- Number of Typical RVTMs and CILs
- Number of TCRs per Typical RVTM and CIL
- Number of Submittal Specific RVTMs and CILs
- Number of TCRs per Submittal Specific RVTMs and CILs
- Number of supporting documents, broken down by type, i.e. RFIs, DVRs, etc.
- Number and percentage of clarified or changed TCRs per Typical RVTMs and CILs
- Number and percentage of clarified or changed TCRs per Submittal Specific RVTMs and CILs
- Number of planned Technical Contract Submittals
- Number of submitted Technical Contract Submittals
- Number of accepted (Approval, SONO) Technical Contract Submittals Number
- Number of outstanding Technical Contract Submittals

The module of metrics shall be submitted as part of the RM tool submittal.

The Contractor shall hold monthly Technical Exchange Meetings to apprise the Authority's Representative of the progress of the V&V activities.

2.3 Contractor Verification and Validation Submittal

Provide a V&V submittal with every Technical Contract Submittal. The V&V submittal includes the following:

- RVTM as defined in Section 2.3.1
- CILs as defined in Section 2.3.2
- Certificate of Conformance Packages (CCP) as defined in Section 2.3.3 for RFC submittals
- Contractor V&V report as defined in Section 2.3.4

2.3.1 Requirements Verification and Traceability Matrix (RVTM)

Demonstrate compliance to Technical Contract Requirements using Submittal Specific RVTMs. An RVTM example is provided in Appendix A. Submittal Specific RVTMs shall be based on Typical RVTMs provided by the Authority's Representative within twenty (20) business days after acceptance of the Contractor Verification and Validation Plan.

Manage the RVTM only in the RM tool. The RVTM shall be based on RM tool views and traces within the RM tool. Use DOORS eXtension Language (DXL) as necessary to create the required views.

Export the RVTM directly from the RM tool prior to submittal. Do not edit the RVTM outside the RM tool. Provide the exported RVTM in an electronically searchable PDF format and in Microsoft Excel format to the Authority's Representative with every V&V submittal. Do not use scanned PDFs.

The RVTM shall identify for each Technical Contract Requirement any approved changes or clarifications and the appropriate section references to the final design, construction, inspection, testing, and acceptance.

The RVTM shall provide the following information:

- Technical Contract Requirement
  - Unique requirements identifier
  - Contract document identifier and section reference including section number and name
  - Technical Contract Requirement language
- Changed or Clarified Contract Language
  - Changed or Clarified Contract Requirements language
- Final Design and Construction Submittals
  - Unique submittal identifier (e.g. submittal number)
  - Submittal name
  - Submittal document section reference including section number and name

When supplying the references, apply the lowest practical level of precision, for example:

- Unique drawing number

- Smallest practical numbered section in a document.

The RVTM shall be provided in an uncluttered fashion without any irrelevant information folder and path names, unrelated attributes, or similar. Do not provide any unnecessary or unverifiable references, or ranges of references if the objective evidence is shown only on a subset of the provided references.

Submit the RVTM to the Authority's Representative as defined in Section 3.4.

2.3.2 Certifiable Items List (CIL)

Demonstrate compliance to Critical Items using CILs. The CIL shall include:

- Safety requirements including hazard mitigations (refer to PHA in SSMP, Book 4)
- Security requirements including threat mitigations (refer to TVA in SSMP, Book 4)
- Interoperability items (interfaces) with other contracts and third parties of the California High-Speed Train project (refer to Appendix B)

The CIL template shall be based on the RVTM template. Typical CILs will be provided by the Authority's Representative within twenty (20) business days after acceptance of the Contractor Verification and Validation Plan.

Use the provided CIL as a baseline. Maintain the CIL during the life of the Contract by adding additional items as directed. Any other edits require prior written approval from by the Authority's Representative.

Manage the CIL only in the RM tool. The CIL shall be based on RM tool views and traces within the RM tool. Use DOORS eXtension Language (DXL) as necessary to create the required views.

Export the CIL directly from the RM tool prior to submittal. Do not edit the CIL outside the RM tool. Provide the exported CIL in an electronically searchable PDF format and in Microsoft Excel format to the Authority's Representative with every V&V submittal. Do not use scanned PDFs.

The CIL shall identify for each Critical Item the appropriate references any approved changes or clarifications and the appropriate section references to the final design, construction, inspection, testing, acceptance, and certification.

Submit the CIL to the Authority's Representative as defined in Section 3.4.

2.3.3 Certificate of Conformance Packages (CCP)

Certificate of Conformance Packages shall be prepared for RFC submittals and submitted to certify compliance to Critical Items by providing documented objective evidence, including:

1. Cover and sign-off sheet
2. Certifiable items list (CIL) containing critical items and references to the objective evidence

3. Excerpts from the submittal of the referenced objective evidence

Depending on the type of critical item, specific CCP requirements exist, as described in the following sections.

2.3.3.1 Safety and Security Certification

The Safety and Security Certificate of Conformance Package shall follow the generic CCP requirements described above and the safety and security specific requirements described in the General Provisions and the Safety and Security Management Plan.

The CCP shall be prepared separately for Ready for Construction and Construction. Provide one (1) submittal specific CCP:

- Ready for Construction:
  - With each Ready for Construction submittal for each Design Submittal Type (Section 2.1.3)
- Construction:
  - Upon completion of construction of the Critical Items listed in the Final Design CCP

Upon completion of construction, provide one summary CCP including all safety and security Critical Items referencing the submittal specific CCPs.

Coordinate with the Authority's Safety and Security Representative for the detailed implementation.

2.3.3.2 Interface Certification

The Interface Certificate of Conformance Package shall follow the generic CCP requirements described above and be implemented as an Interface Control Document (Section 2.1.4).

Interface Control Documents shall serve as Certificate of Conformance Packages. Prepare an ICD for each interoperability item (interface). The ICD shall be certified separately for Ready for Construction and Construction.

Coordinate with the Authority's Interface and Integration Representative for the detailed implementation.

2.3.4 Contractor Verification and Validation (V&V) Report

Provide a V&V report with every Technical Contract Submittal.

Use the V&V report to provide a submittal-specific executive summary and a Certificate of Compliance with Technical Contract Requirements. Provide additional explanation as necessary on how the Technical Contract Submittal meets the Technical Contract Requirements that is not readily available from the RVTM or CILs. Variances between Technical Contract Requirements and the Technical Contract Submittal shall be explicitly identified and discussed in the V&V report.

The certification of compliance within this V&V report shall include the confirmation by the Contractor's V&V Manager that the references to the objective evidence provided in the RVTM and CILs have been checked by the Contractor's QA/QC process, and have been confirmed as complete, correct and consistent.

3 Execution

3.1 Self-Certification Process Overview

The self-certification process is different from the traditional submittal and review process where the Contractor prepares a submittal for the full Authority review, typically resulting in either approval or rejection of the submittal.

The purpose of the self-certification process is to shift submittal review responsibility from the Authority to the Contractor, whereby the Contractor has to demonstrate compliance resulting in reduced review efforts on the Authority side. This is achieved by Contractor self-certification of compliance, supported by objective evidence (the V&V submittal) demonstrating compliance between the contract and the submittal.

The Self-Certification process applies to Technical Contract Submittals (TCS).

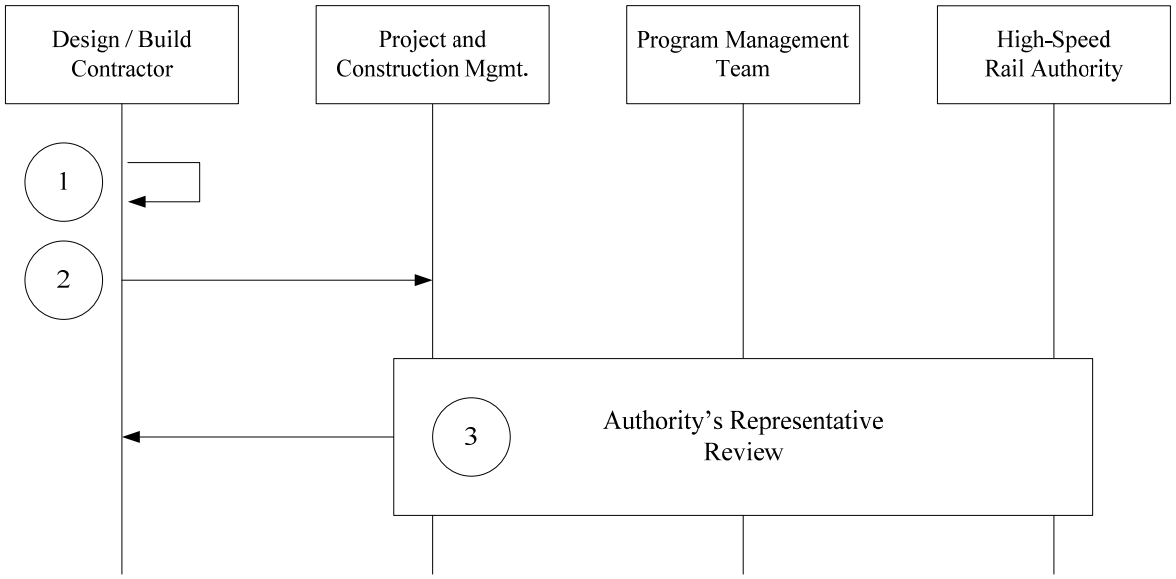

Figure 6: Self-Certification Process

Follow the self-certification process as presented in Figure 6.

1. The Contractor shall prepare Technical Contract Submittal as specified in the Contract and shall perform quality procedures as stipulated by the Contract. Contractor shall self-certify compliance with Technical Contract Requirements and fitness for purpose prior to issuing the submittal to the Authority's Representative for their review. The self-certification statement shall be provided as a Certificate of Compliance to be included in the V&V submittal.
2. Contractor shall submit Technical Contract Submittal, including the V&V submittal for Technical Contract Submittals, to the Authority's Representative for review. The Authority's Representative will perform an independent assessment of the TCS by an Independent Checking/Site Engineer. Should the TCS not meet the Technical Contract Requirements, the TCS will be returned to the Contractor. The Contractor shall address any comments before resubmitting to the Authority's Representative.
3. The Authority's Representative may perform additional due diligence checking (DDC) and audits of the Contractor's V&V process adherence as they deem appropriate.

Unless otherwise noted, the following steps apply to each type of Technical Contract submittal.

Technical Contract Submittal	Step 1	Step 2	Step 3
Prepared, no submittal to Authority	Yes	No	No
Submitted for Information	Yes	Yes	No
Submitted for SONO / Approval	Yes	Yes	Yes

3.1.1 Self-Certification Process involving Third Party Entities

Third party entities include jurisdictional authorities (Caltrans, cities, and counties), railroads, utilities as defined in detail in the CHSTP Scope of Work and the General Provisions.

Contractor shall apply V&V and self-certification as follows:

- CHSTP Work affecting third party entities and NOT affecting CHSTP TCRs:
  - Contractor shall ensure that the CHSTP Work is planned, executed, monitored, controlled and is in compliance with the CHSTP Work
  - Contractor shall demonstrate compliance to the applicable CHSTP Work using full self-certification requirements
  - Contractor and/or third party entity shall follow the third party entity requirements, policies, codes, standards, processes, delivery methods as required by the Contract
- Third party entity Work affecting CHSTP TCRs:
  - Contractor shall ensure that the third party entity Work is planned, executed, monitored, controlled and is in compliance with the CHSTP TCRs
  - Contractor shall demonstrate compliance to the affected CHSTP TCRs using full V&V and self-certification requirements

  - Contractor and/or third party entity shall follow the third party entity requirements, policies, codes, standards, processes, delivery methods as applicable
  - Contractor shall obtain Authority or Authority's representative's input before finalizing any design and/or work acceptance with the third party
- Third party entity Work affecting other third party entities:
  - This Work is considered outside the CHSTP Work and CHSTP TCRs, but CHSTP self-certification requirements still apply to this work
  - Contractor and/or third party entity shall follow the third party entity requirements, policies, codes, standards, processes, delivery methods as required by the Contract

3.2 Contractor Verification and Validation Requirements

3.2.1 Contractor V&V Key Personnel

Employ only professionals with at least 10 years of experience in the stated field of expertise for key positions with a proven track record in the following functions as supported by their resumes:

- Federal projects with Federal Transit Administration or Federal Railroad Administration oversight
- Design/Build contracts
- Systems Engineering with application to transportation and/or infrastructure industry
- Verification and Validation
- Certified Systems Engineering Professionals (CSEP) and/or membership in the International Council on Systems Engineering (INCOSE) is preferred
- Proven continuity through project delivery and commitment for the length of this contract is required
- Presence at the local project office of at least 50%

The skill sets listed below shall be required for individuals to be considered for V&V key personnel positions:

- Verification and validation management
- Quality Assurance and Quality Control
- Requirements management
- Design management
- Interface management
- Inspection and testing management

- Change Control and Configuration Management

The Authority's Representative may elect to designate other positions as V&V key positions or reduce the number of such positions required at any time during the Contract.

Key positions shall not be shared with more than 1 person. One person, however, can hold more than one key position.

Submit resumes of key employees to the Authority's Representative for review and approval if appropriate.

3.2.2 Contractor Verification and Validation Management Plan (CVVP)

Prepare and submit a CVVP in compliance with the requirements defined in Section 2.1.

3.2.3 Requirements Management Tool

Procure an RM tool and follow directions in compliance with the requirements defined in Section 2.2.

3.2.4 Verification and Validation Submittals

Prepare and submit V&V submittals in compliance with the requirements defined in Section 2.3.

3.2.4.1 Requirements Verification Traceability Matrix

Prepare and submit RVTMs in compliance with the requirements defined in Section 2.3.1.

3.2.4.2 Certifiable Items Lists

Prepare and submit CILs in compliance with the requirements defined in Section 2.3.2.

3.2.4.3 Certificate of Conformance Packages

Prepare and submit CCPs in compliance with the requirements defined in Section 2.3.3.

3.2.4.4 Verification and Validation Reports

Prepare and submit V&V reports in compliance with the requirements defined in Section 2.3.4.

3.3 Authority's Representative Review

Upon submittal of Technical Contract Submittals, the Authority's Representative will perform a review of the Contractor's submittal. An additional audit of the Contractor's adherence to the verification, validation and self-certification process may be performed as deemed necessary.

The Authority's Representative may require consultations with the Contractor's engineers for the various disciplines involved in the part of the work under review. The Contractor shall ensure that the relevant staff is available to participate in such consultations.

The Authority's Representative may request additional reviews as considered necessary to ensure a continued and uniform consistency in the quality and effective incorporation of revisions to submittals and/or the Contractor may request additional reviews to facilitate release of designs for construction.

3.4 Submittals

Provide the following submittals. Refer to the referenced sections for details.

Section	Submittals	Submit For	Timeframe
	Mobilization		
3.1.1	Key Personnel Resumes	Approval	Prior to hiring
2.2.1	RM Tool – Procured Licenses	Information	30 days after NTP
2.2.1	RM Tool – Installed	Information	30 days after NTP
2.2.1	RM Tool – Web-Access	Information	30 days after NTP
	Planning		
2.1	CVVP – Kickoff Meeting	Information	15 days after NTP
2.1	CVVP – Draft	Approval	45 days after NTP
2.1	CVVP – Final	Approval	90 days after NTP
2.1.3	Design Management • Design Submittal Types • Design Submittal Completeness	 Approval Approval	 As part of CVVP 90 days after NTP
2.1.4	Interface Management • Planned Interface Coordination Workshops • Formed Interface Coordination Team	 Approval Information	 As part of CVVP 90 days after NTP
2.1.5	Inspection and Test Management • Individual Inspection and test management plans	SONO	Four weeks prior to inspection or testing
2.1.7	Change Control and Configuration Management • Identified Configuration Items • Identified Configuration Baselines	 Approval Approval	 As part of CVVP As part of CVVP
	Execution		
2.1.4	Interface Management • Interface workshops • Resolved interface conflicts	 Information Information	 As per approved CVVP Prior to 60% Submittals
2.1.5	Inspection and Test Management • Preparation of inspections and test procedures • Execution of inspections and test • Inspection and test report	 SONO Information SONO	 Four weeks prior to inspection or testing One week notification Two weeks after inspection or test

Section	Submittals	Submit For	Timeframe
2.2.1	RM Tool	SONO	Monthly RM tool submittal
2.2.4	Supporting Documents • Capture and trace supporting documents within two weeks of receipt	SONO	With monthly RM tool submittal
2.3	V&V Submittal	SONO	With every Technical Contract Submittal
2.3	Certificate of Conformance Packages • Final Design • Construction • Summary CCP	 Approval Approval SONO	 With RFC TCS After Construction After Construction
	Monitoring and Control		
2.2.5 2.2.6	RM Tool • Verified • Validated	SONO	With monthly RM tool submittal
2.2.7	Performance Metrics and Reporting	Information	With monthly RM tool submittal

APPENDIX A – RVTM Template

Contractor to include clarifications and changes, update clarified or changed requirements language, and provide tracing to objective evidence.

Table Tools Discussions User Change Management Help

All levels

ID	Requirements ID	Requirements Section	Requirements Language	Clarified or Changed Requirements Language	Submittal ID	Submittal Name	Submittal Section
1	DCM.04.163	4.4.5.3 Unbalanced Superelevation	DCM.04.163: The maximum Eu shall be limited to 3 inches.	N/A	10001	60% At-Grade Submittal XXX	Drawing XYZ
2	DCM.06.19 TPA-RRXX-2	6.3.1.1 Protection Measures without Physical Barriers 1.1.1 Railroad Agreement XX	DCM.06.19: The preferred protection is to locate HST operating infrastructure at a sufficient distance from conventional railroad systems to avoid intrusion. A lateral distance of 102 feet or greater measured between the closest track centerlines (TCL) of the conventional railroad and HST system does not require a physical barrier for intrusion protection. Alternatively, when the HST track is 10 feet or higher than the conventional railroad top of rail (e.g., HST track on embankment or retained fill), use of a physical barrier for intrusion protection of HST operating infrastructure is not required. TPA-RRXX-2: Freight xxx railroad requires 102 feet between HST track centerline and railroad right-of-way (ROW) …	The lateral distance between the HST system and conventional railroads shall be 102 feet or greater between track centerlines (TCL) …			
3	SOW-6 DCM.28.994 RFI-13	5 SITE WORK 28.5.6.1 At-Grade, Embankment, Cut Systems Conduits at Track 12 RFI XX	SOW-6: CONTRACTOR SHALL LOCATE, DESIGN, AND CONSTRUCT LOW-VOLTAGE UNDER TRACK CONDUIT DUCT BANKS AND ACCOMPANYING MANHOLES IN AT-GRADE, CUT/FILL, … • TWELVE-CONDUIT LOW-VOLTAGE DUCTBANK AN D TWO LOW-VOLTAGE MANHOLE ASSEMBLY: QUANTITY 4 AT APPROXIMATE LOCATIONS: XXX DCM.28.994: The Designer shall provide concrete-encased, undertrack conduit ductbank consisting of Trade Size 4 conduits terminating at manholes at the locations and quantities depicted on Table 28-3 for at-grade, embankment and cut sections. RFI-13: As agred in Interface Workshop XYZ train control site A currently located at XYZ and train control site B currently located at XYZ shall be combined into one train control site to be located at XYZ.	Provide and install low-voltage concret-encased undertrack conduit ductbancks consisting of twenty (20) trade size 4 conduits and accompanying manholes at the following train control site locations …			

Contract Changes & Clarifications

Contract Changes & Clarifications

Updated Contract Language

Traces to Objective Evidence

APPENDIX B – Interoperability Items

California High-Speed Rail Program

CP4 Certifiable Items List

RFP No.: HSR 14-32 – Addendum No. 2 - 10/09/2015

California High-Speed Rail Program
CP4 Certifiable Items List
Safety (CEHL)

1 Infrastructure
- 1.1 R-O-W Generally
  - 1.1.1 Derailment
    - 1.1.1.1 Roadbed Failure
    - 1.1.1.2 Washout caused by flooding or scouring
    - 1.1.1.3 Slide
    - 1.1.1.4 Seismic Activity
    - 1.1.1.5 High Winds
  - 1.1.2 Collision
    - 1.1.2.1 Collision between HSR trains
    - 1.1.2.2 Non-HSR train enters HSR trackway from adjacent exclusive corridor.
    - 1.1.2.3 Collision with a highway vehicle at an at-grade crossing
    - 1.1.2.4 Highway vehicle enters the HSR trackway from an overpass
    - 1.1.2.5 Highway vehicle enters the HSR trackway from an adjacent roadway
    - 1.1.2.6 Object thrown from overpass
    - 1.1.2.7 Trespasser
    - 1.1.2.8 Livestock/Wildlife
    - 1.1.2.9 Flooding standing water
  - 1.1.3 Fire and Smoke
    - 1.1.3.1 Fire and/or smoke on at-grade alignment
    - 1.1.3.2 Wayside fire and/or smoke adjacent to an at-grade alignment
  - 1.1.4 Close Proximity
    - 1.1.4.1 Passing train effects persons or vehicles adjacent to but outside the HSR R-O-W
    - 1.1.4.2 Passing HSR trains affect each other
    - 1.1.4.3 Leak or rupture in hazmat pipeline crossing under or adjacent HSR trackway.
    - 1.1.4.4 Leak or rupture in non-hazmat pipeline crossing under or adjacent HSR trackway.

1.1.4.5 Overhead high voltage lines collapse onto ROW or are struck during construction / maintenance activities
1.1.4.6 Other overhead utility lines (telephone cable etc) collapse onto ROW or are struck during construction / maintenance activities
1.1.4.7 Underground utilities struck during construction / maintenance activities
1.1.4.8 Structures adjacent the ROW collapse onto the ROW during seismic event
1.1.4.9 Adjacent wind turbine suffers rotor failure or structural collapse with resulting intrusion of debris into the ROW.
1.1.4.10 Adjacent oil/gas well has surface-level blowout. Result is fire earth displacement and intrusion into the ROW by debris from the explosion.
1.1.5 Other
1.1.5.1 Evacuation from at-grade alignment
1.1.5.2 Dense ground fog impairs visibility
1.2 R-O-W Structures
1.2.1 Elevated Structures
1.2.1.1 Collapse - Fatigue
1.2.1.2 Collapse - Exceed capacity of structure
1.2.1.3 Collapse - Seismic activity
1.2.1.4 Collapse - Struck by non-HSR train
1.2.1.5 Collapse - Struck by highway/oversize vehicle
1.2.1.6 Collapse - Washout/Erosion
1.2.1.7 Fire on elevated structure
1.2.1.8 Fire/smoke from adjacent R-O-W structures or wildfires adjacent the R-O-W
1.2.1.9 Train falls from elevated structure.
1.2.1.10 Person falls from elevated structure.
1.2.1.11 Evacuation required.
1.2.1.12 Collapse - Unsupported foundation or ground movement
1.2.2 Tunnel Structures
1.2.2.1 Seismic activity
1.2.2.2 Fire or smoke inside tunnel
1.2.2.3 Train impact with tunnel wall
1.2.2.4 Train impact with tunnel portal face
1.2.2.5 Evacuation from tunnel structure

1.2.2.6 Seepage of hazardous gas from ground hazmat spill during maintenance activities inside tunnel
1.2.2.7 Air pressure pulses as train passes through confined space at high speed.
1.2.2.8 Pressure buildup as HSR trains pass each other at speed in confined spaces.
1.2.2.9 Collapse due to inward pressure exceeding the capacity of the tunnel structure
1.2.3 Below-Grade / Trench Structure
1.2.3.1 Seismic activity
1.2.3.2 Fire in below-grade structure.
1.2.3.3 Impact wall of structure.
1.2.3.4 Evacuation required.
1.2.3.5 Flooding caused by rain/stormwater runoff
1.2.3.6 Flooding caused by breach in overhead canal
1.2.3.7 Person falls into below-grade structure
1.2.3.8 Collapse - Inward pressure exceeds the capacity of the trench structure
1.2.4 Other Structures
1.2.4.1 Raised Embankments - Sliding / Collapse
1.2.4.2 Exposed precipices at culverts retaining walls and other raised structures
1.2.4.3 Person enters confined space / culvert
1.2.4.4 Overhead structures collapse onto R-O-W due to seismic activity.
1.2.4.5 Overhead structures collapse onto R-O-W due to fatigue.
1.2.4.6 Retaining wall - collapse due to seismic activity
1.2.4.7 Evacuation from retained fill or raised embankment trainway

Security (TVA)

1 ROW
1.1 Asset
1.1.1 ROW At-grade Right of Way
1.1.1.1 IED
1.1.1.2 VBIED
1.1.1.3 Sabotage
1.1.1.4 Arson/IIED
1.1.1.5 Crime
1.1.1.6 Crime

- 1.1.2 Bridge/Elevated Structure
  - 1.1.2.1 VBIED
  - 1.1.2.2 IED
  - 1.1.2.3 Sabotage
  - 1.1.2.4 Crime
- 2 Systems
  - 2.1 Asset
    - 2.1.1 Traction Power Station
      - 2.1.1.1 IED
      - 2.1.1.2 Sabotage
      - 2.1.1.3 Cyber Attack
      - 2.1.1.4 Crime
      - 2.1.1.5 Crime
      - 2.1.1.6 Ramming
    - 2.1.2 Signals
      - 2.1.2.1 IED
      - 2.1.2.2 Sabotage
      - 2.1.2.3 Arson/IIED
      - 2.1.2.4 Cyber Attack
      - 2.1.2.5 Crime
    - 2.1.3 Switches
      - 2.1.3.1 IED
      - 2.1.3.2 Sabotage
      - 2.1.3.3 Cyber Attack
      - 2.1.3.4 Crime
    - 2.1.4 Interlocking (IL)
      - 2.1.4.1 IED
      - 2.1.4.2 Sabotage
      - 2.1.4.3 Cyber Attack
      - 2.1.4.4 Crime
- 3 Infrastructure

- 3.1 Asset
  - 3.1.1 Track
    - 3.1.1.1 IED
    - 3.1.1.2 Sabotage
    - 3.1.1.3 Crime
    - 3.1.1.4 Crime

California High-Speed Rail Program

CP4 Interoperability Items (IF-REG)

California High-Speed Rail Program
CP4 Interoperability Items (IF-REG)

1 General
- 1.1 Reliability, Availability, Maintainability & Safety
  - 1.1.1 Interfaces with Guideway (excl. Trackwork)
    - 1.1.1.1 Reliability & Availability
      - 1.1.1.1.1 Interface between GEN Reliability & Availability Targets and GWY Infrastructure

2 Operations & Maintenance
- 2.1 Operations
  - 2.1.1 Interfaces with Guideway (excl. Trackwork)
    - 2.1.1.1 Design & Operating Speeds
      - 2.1.1.1.1 Interface between O&M Maximum Design Speed (HST Tracks) and GWY Infrastructure
      - 2.1.1.1.2 Interface between O&M Maximum Design Speed (Special Trackwork) and GWY Infrastructure
    - 2.1.1.2 Operation Simulation / Computer-Based Modeling
      - 2.1.1.2.1 Interface between O&M Computer-Based Modeling and GWY Infrastructure
    - 2.1.1.3 Visibility of Wayside/Trackside Equipment
      - 2.1.1.3.1 Interface between O&M Visibility of Wayside/Trackside Equipment Requirements and GWY Infrastructure
- 2.2 Maintenance
  - 2.2.1 Interfaces with Guideway (excl. Trackwork)
    - 2.2.1.1 MoI Roadway Access
      - 2.2.1.1.1 Interface between O&M MoI Infrastructure Access Requirements and GWY Infrastructure
    - 2.2.1.2 MoI Walkway & Stairs
      - 2.2.1.2.1 Interface between O&M MoI Walkway Spatial Requirements and GWY Infrastructure
      - 2.2.1.2.2 Interface between O&M MoI Access Stairway Spatial Requirements and GWY Infrastructure
    - 2.2.1.3 MoI Live Loads
      - 2.2.1.3.1 Interface between O&M MoI Walkway Floor Live Load Requirements and GWY Infrastructure

4.1.1.4.1 Interface between RST HST Trainset Axle Loads and GWY Infrastructure
4.1.1.4.2 Interface between RST HST Trainset Dynamic Train-Structure Interaction Analysis and GWY Infrastructure
4.1.1.4.3 Interface between RST HST Trainset Traction & Braking Forces and GWY Infrastructure
4.1.1.4.4 Interface between RST HST Trainset Nosing & Hunting Effects and GWY Infrastructure
4.1.1.4.5 Interface between RST HST Trainset Derailment/Collision Loads and GWY Infrastructure
5 Guideway (excl. Trackwork)
5.1 Drainage
5.1.1 Interfaces with Operations & Maintenance
5.1.1.1 Maintenance
5.1.1.1.1 Interface between O&M MoI Pump Station Site Access Requirements and GWY Infrastructure
6 External
6.1 Amtrak
6.1.1 Interfaces with Guideway (excl. Trackwork)
6.1.1.1 Vehicle Static Gauge & Dynamic Envelope
6.1.1.1.1 Interface between EXT Amtrak Trainset Dynamic Envelope Requirements and GWY Infrastructure
6.1.1.2 Loads & Forces
6.1.1.2.1 Interface between EXT Amtrak Trainset Axle Loads and GWY Infrastructure
6.1.1.2.2 Interface between EXT Amtrak Trainset Dynamic Train-Structure Interaction Analysis and GWY Infrastructure
6.1.1.2.3 Interface between EXT Amtrak Trainset Derailment/Collision Loads and GWY Infrastructure
6.2 Construction Equipment
6.2.1 Interfaces with Guideway (excl. Trackwork)
6.2.1.1 Loads & Forces
6.2.1.1.1 Interface between EXT Construction Equipment Axle Loads and GWY Infrastructure
6.2.1.1.2 Interface between EXT Construction Equipment Dynamic Train-Structure Interaction Analysis and GWY Infrastructure